

come to recognise its educational and industrial importance. It will be individuals who will lead in this recognition; and we must therefore rely, as the Americans have done, mainly on the public spirit of citizens. The reports of the United States Commissioner of Education show that there has been in recent years a steady increase, year by year, both in the benefactions and in the Government grants which the universities and colleges have received, culminating in 1898-9 (the date of the latest report) in benefactions amounting to 4,400,000*l.* for that one year, and Government grants amounting to 1,500,000*l.*—facts which fully explain how it is that the great universities, which, of course, have been receiving the lion's share, have been able to build up, in a comparatively short time, well-equipped research schools in many departments of study. If we are to do the same, we must not rest satisfied with the equipment which the Carnegie fund can provide, but must supplement it with a liberality which, if not individually so princely as Mr. Carnegie's, will collectively exceed it in amount.

And here let me suggest that the endowment of research in Natural Philosophy in this university might well form the first instance of such enlightened liberality. Tait needs no effort of ours for the perpetuation of his name. By his scientific work he has raised for himself, as a distinguished leader in the advancement of knowledge, a more lasting monument than any that we could erect. But of his services to the University and the State there is no memorial. There are thousands of his students who have drunk from the well of his inspiration and been made stronger men by the draught. There are tens of thousands of his fellow-citizens whose pride in the Scottish metropolis has received new justification from his whole-souled devotion to its maintenance as a centre of light and leading. Is it too much to expect that they should found a research laboratory bearing his name, and thus appropriately mark their appreciation of a great Scotsman who showed by the exercise of his own creative power that Britain at least shares in the intellectual leadership of the world, and by the cultivation of creative power in his students did what he could to maintain her industrial leadership as well?

There would be little advantage in the possession of research funds, however, without full freedom to use them; and at present they could be used only to a limited extent. Research work is recognised in our universities as qualifying for certain high degrees, so high that no one is supposed to be fitted for them until five years have elapsed from the date of his having become a Master of Arts or a Bachelor of Science, so high consequently that they are taken only by the few. It is not recognised as qualifying for the M.A. and B.Sc. degrees themselves, and any time which may be spent by an undergraduate in investigation is thus condemned by our regulations to be, so far as the degree is concerned, "time elaborately thrown away." Nor is it easy to gain full freedom to teach by research; for when we ask how the recognition of research study in the undergraduate courses is to be obtained, we find that changes in regulations can be made only with the concurrence of the Scottish Universities Committee of the Privy Council, and that it is hopeless to expect the concurrence of this Committee unless it is asked for by at least two universities. It will at once be obvious that the advocate of reform has an arduous task. For he must persuade in succession his own university, a second university, and the Privy Council Committee. And this procedure is requisite, not merely to secure the desired recognition of research study, but to carry out any large measure of reform. It has obviously been devised with the object of preventing hasty and ill-considered change on the part of any of our universities, and any change whatever which does not commend itself to more than one. It may be admitted at once that it is admirably suited to the purpose; for if we think of the correspondence involved in the advocacy of any reform, the iteration and reiteration of argumentation, the button-holing, perhaps even the lobbying and "log-rolling," it becomes apparent that no better system could be devised to dampen the enthusiasm of the reformer and to perpetuate things as they are.

It is perhaps improper in one who has only recently joined your staff of teachers, and may not be fully acquainted with the advantages of the organisation referred to, to express any decided opinion about it. But, as an old student, who for years has been watching the course of his Alma Mater from afar, and is thus in a position to let you see yourselves as others see you, I may allow myself to say that the Ordinances of the Scottish Universities Commission and the authority of the Privy Council Committee seem to me to be millstones about the necks

of the Scottish universities, which, unless the universities have a supernatural buoyancy, must sink them lower and lower relatively to the progressive universities of the world.

The most important condition of the steady progress of the German university has been the *Lehrfreiheit*, and the corollary insisted upon by the universities and recognised by the State, that when the best available teachers have been selected they must be supposed to know better than any external committee what is to be taught and how the teaching is to be done, and that consequently they must be free to regulate and modify their teaching as knowledge advances and as methods are improved.

And, similarly, one essential condition of the progress of the American university has been its autonomy. Johns Hopkins University, non-existent twenty-five years ago, is to-day one of the leading universities of the world, because it put at its head a talented educational reformer and gave him a free hand; and in consequence of a similar policy, Harvard, in the last quarter of a century, has been transformed from being a leading American university to being a leading world's university. These two great institutions work on quite different lines. Had either required to persuade the other of the value of its organisation and then to persuade a Committee of Congress, it is safe to assert that the extraordinary development which both have exhibited would never have occurred.

The question of the relation of the universities to the Privy Council Committee, of the advantages of individual as opposed to collective development, of the kinds of change which ought to be capable of being made from within, and the kinds which ought to be submitted to an external tribunal—these are questions of too great complexity to be discussed in the last paragraphs of an address. But when the introduction of research work into the undergraduate courses is found to be among the reforms which must wait for collective action and the consent of an external body, it becomes obvious, I think, that the line between changes which may be made from within and changes which require approval from without has been so drawn as to hamper unduly the development of our universities, and that it requires to be redrawn in the spirit of progress.

Meantime, as to the particular change which I am advocating to-day, we need not despair. Reform in this direction is in the air. Under the stress of the national industrial crisis and the growing conviction that something must be wrong in our educational system, those educationists who have long advocated it are securing to-day an attention such as they have never before received. And when we find the Chancellor of the University of Birmingham, a leading Cabinet Minister, eager to introduce research into his university, and the chairman of the Educational Section of the British Association, our Minister of Education, as eager to introduce it into his schools, we are encouraged to hope that at no distant date the movement may be fully developed which was inaugurated in this university through the profound educational insight of Prof. Tait, and that all our universities may be enabled to exert the stimulating influence that schools of the higher education should do, not merely on industrial development, but on all forms of progressive activity.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Financial Board has published a proposal that the University should purchase some six acres of land belonging to Downing College, and adjoining the new buildings for geology and botany. The site is practically the only one now available for the extension of the museums, and it will, if not secured by the University, be divided up by new streets for ordinary building purposes. The price is about 25,000*l.*, which, in the absence of benefactions, will have to be raised by loan.

Dr. Anningson, Dr. Collingridge, Prof. Woodhead, Mr. J. E. Purvis and Dr. Tatham have been appointed University examiners in sanitary science.

At a meeting held under the auspices of the Philosophical Society on November 18, it was decided to invite the British Association to visit Cambridge in 1904 or 1905.

MR. CARNEGIE has announced that he will give 400,000*l.* more to Pittsburgh, half to the Carnegie Institute and half to the new technical school, the building of which will shortly be commenced.

FROM the Report of the Somerset County Education Committee we learn that an experimental farm has been established under the auspices of the committee at Bickenhall, near Taunton, where systematic observations are made and experiments conducted on the breeding, feeding and produce of farm animals, more especially those usually found on a dairy farm. Experiments are also made on the production of various crops.

THE annual meeting of the Association of Headmasters of Higher Grade Schools and Schools of Science was held on Friday last at the rooms of the Society of Arts. Mr. E. J. Cox, Headmaster of the George Dixon Higher Grade School, Birmingham, delivered his presidential address, taking for his subject the recent return of the Board of Education, which gives statistics relating to schools of science in connection with board schools and certain conclusions which have been drawn from the return by a section of the Press. Mr. Cox, and the association over which he presides, maintain that these schools of science are providing a thorough and suitable preparation for boys who will later proceed to workshops and factories. Judging by the remarkable unanimity of the reports of the inspectors of the Board of Education, South Kensington, it may certainly be said that these schools provide the best preparation for the later work of the technical school to be obtained in this country. It is to be hoped that future legislation will provide a place in the national system of education for schools of this character, since they effectually ensure that the brightest children of the elementary schools shall receive practical instruction in the methods of science. It is a hopeful sign for the future of English education that several representatives of different trade societies were present at the meeting and showed by their speeches that they understood the value of a knowledge of science to all engaged in manufacture.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Astronomical Society, November 8.—Dr. J. W. L. Glaisher, president, in the chair.—Mr. S. A. Saunderson read a paper on the determination of selenographic positions and the measurement of lunar photographs. This was a second paper on the subject, dealing with the determination of a first group of standard points on the moon, by measures made at the telescope and on photographs. Prof. Turner said this was a work in which those could assist who possessed telescopes of moderate aperture, as it had been found that very large apertures were unsuited for measures of the lunar surface.—Father Sidgreaves read a paper on the spectrum of Nova Persei from February 28 to April 26; with an appendix, dealing with its spectrum in August and September. Photographs were shown of the spectrum taken at Stonyhurst on August 27 and September 5, when it had become a bright-line spectrum, some of the lines remaining very broad and well defined.—Mr. A. R. Hinks gave an account of the experimental reduction of some photographs of Eros made at Cambridge Observatory for the determination of solar parallax; he explained the methods employed and gave some preliminary results.—Mr. H. C. Plummer read a paper on periodic orbits in the neighbourhood of centres of libration.—Mr. Bellamy read his paper on the place of the variable star RU Herculis and the neighbouring stars from photographic measures.—Prof. W. W. Campbell, Prof. J. Scheiner and M. Ch. Trépied were elected associates of the Society.

Linnean Society, November 7.—Prof. S. H. Vines, F.R.S., president, in the chair.—Mr. W. Botting Hemsley, F.R.S., on behalf of the Director of the Royal Gardens, Kew, exhibited the following specimens:—(1) A West Australian umbelliferous shrub, *Sieberta deflexa*, which produces tubers, called *Yuke* by the aborigines, who eat them both raw and cooked. Many shrubs in dry countries form large tuberous stocks from which annual stems spring; but the tubers of *Sieberta deflexa* grow in strings showing no trace of eyes or buds, but scars where stems may have been detached. Whether independent plants spring from the separate tubers is a question which remains to be determined. (2) Germinating seeds of *Araucaria Bidwillii*, received from Grahamstown. The peculiarity in the germination is that there are two distinct stages; in the first stage the radicle emerges from the shell of the seed, eventually bringing out the petioles of the cotyledons and the axis of the plantlet. The

radicle grows into a carrot-shaped woody body, from which the petioles of the cotyledons disarticulate, leaving a few minute rudimentary leaves forming the point of the plumule. After some weeks the second stage begins with the elongation of the plumule, which eventually becomes the trunk of the tree. It appears that the second stage may be delayed a considerable time without loss of vitality. The germination of the seeds of *Araucaria Bidwillii* had been previously observed, and the process has been described and illustrated in Regel's "Gartenflora," 1865, p. 103; but the two stages of growth escaped notice. Another peculiarity is there pointed out: each seed contained two or more embryos, which germinated and grew so that 164 plants were raised from seventy-five seeds. *Araucaria Bidwillii* is the *Bunya-bunya* of Queensland, and the seeds were formerly an important article of food of the Australian aborigines. (3) A drawing of *Archidendron solomonensis*, a new pluricarpellary leguminous tree, native of the Solomon Islands, where it was discovered by Archdeacon Comins. In this instance there were three ripe pods developed from one flower; and it was explained that in the flowering stage there were usually eight carpels; but they probably rarely, if ever, all reach maturity. The genus *Archidendron* was founded on an Australian species, and since then several other species have been discovered in New Guinea and the adjacent islands. (4) A selection of South African species of *Helichrysum* showing the great diversity in habit, foliage and flowers displayed by this very large genus of Compositæ.—Dr. Kendle showed germinating seeds of *Crinum longifolium*, received from Mr. E. A. Bowles, as an example of the so-called bulbiform seeds which characterise this and some other allied genera of Amaryllidæ.—The president directed attention to a specimen of *Luzula nivea* from a cultivated plant of unusual dimensions.—Mr. Cecil Warburton, on behalf of Miss Alice Embleton and himself, read a paper on the life-history of the black currant gall-mite, *Eriophyes (Phytoptus) ribis*, hitherto very imperfectly known, and dealt particularly with its behaviour during the migration-period, which lasted from the middle of May to the middle of June. Its natural enemies and its relation to the red currant plant were also discussed.—Mr. C. B. Clarke, F.R.S., communicated some notes on the types of species of *Carex* in Boot's Herbarium.

CAMBRIDGE.

Philosophical Society, October 28.—Mr. J. Larmor, vice-president, in the chair.—Prof. A. Macalister was elected president for the session 1901-2.—Notes on minerals from the Lengenbach Binnenthal, with an analysis by Mr. H. Jackson, by Mr. R. H. Solly (see vol. lxiv. p. 577, October 10).—Some remarks on the notion of number, by Dr. Hobson.—The Hall effect in gases at low pressures, by Mr. H. A. Wilson. The experiments described in this paper were undertaken with the object of detecting and investigating the Hall effect in the positive column of the ordinary electric discharge at low pressures. A vacuum tube was constructed having two small electrodes 6.5 millimetres apart, attached to a stopper ground into a side tube, joined on at right angles to the main discharge tube. By rotating the stopper the two small electrodes could be made to lie both in the same equipotential surface of the positive column. The difference of potential between these electrodes was measured by means of a quadrant electrometer, and the stopper was turned until the electrometer deflection was zero. A magnetic field was then applied perpendicular to the line joining the two small electrodes and to the direction of the discharge. It was found that the field produced a difference of potential between the small electrodes which appeared to be a true Hall effect and was proportional to the magnetic field. In the uniform positive column this transverse potential gradient was found to be nearly independent of the current through the tube and inversely proportional to the pressure of the air in the tube. At 1 millimetre pressure the difference between the velocities of the negative and positive ions due to one volt per cm. was found to be $14 \times 10^4 \frac{\text{cms.}}{\text{sec.}}$.—On some problems in elec-

tric convection, by Mr. G. T. Walker. The paper deals with problems involving the motion of electrified particles through dielectrics which are themselves in motion relative to the ether. It is shown that if space on one side of an infinite plane be occupied by a dielectric and this medium be moving at right angles to its bounding plane, the determination of the electric and magnetic forces due to a point-charge possessed of a velocity